Anaerobic treatment of low concentrated wastewater with newly developed MBR-systems

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Abstract

Anaerobic biological wastewater treatment, the oldest known treatment process, shows some advantages over the aerobic treatment:

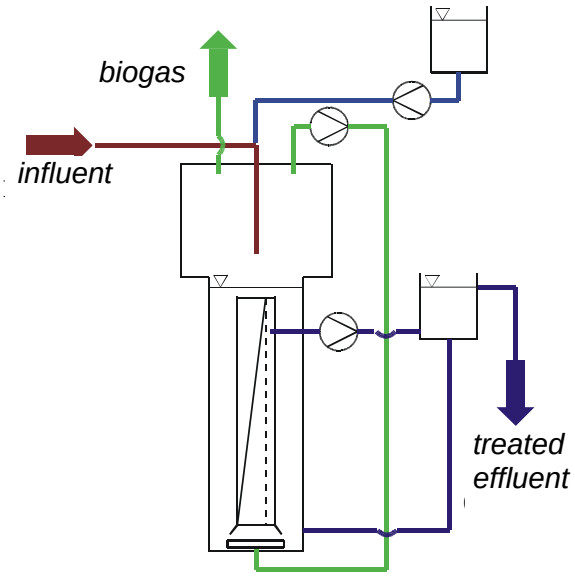
- low energy consumption,
- low excess sludge production
- and the generation of products with high energy content (biogas).

But because of the demand of high organic loads and the general necessity of a post treatment step, the anaerobic treatment of municipal wastewater with its low organic load and the severe effluent standards was not economical so far.

Within this work, a new technology for the treatment and reuse of municipal wastewater was developed. For that purpose, the anaerobic water treatment technology supported by membrane separation was refined in order to overcome the problems in treating low strength effluents like municipal wastewater. The focus of this work was to transform municipal wastewater into useful products like biogas and water containing valuable fertilizers for irrigation using a combination of a mass transfer optimised reactor system with an adapted membrane separation step.

After the first lab-scale investigations a screening of a number of different membranes resulted in basic data of the membrane separation of biomass and led to a membrane pre-selection for the pilot-scale plant. The next step was the design, the construction and the set-up of an adapted pilot plant. The plant was operated over a long period to collect data on the feasibility and stability of the treatment technique. Beside cross-flow membrane systems, submerged membranes were applied and optimised to improve the economy of the process especially in terms of energy demand.

With the newly developed anaerobic MBR-systems the treatment of low loaded wastewaters like municipal wastewater was possible without any post-treatment step. The plant produced biogas and the surplus sludge production was very low due to the anaerobic reaction. This made the process cost effective and competitive to aerobic systems. Germs and micro organisms are rejected completely because of the membrane filtration step and the direct reuse of the effluent became possible without any hygienic risks. Furthermore, the submerged system operated energetically self-sufficient.



Sketch of the anaerobic loop flow reactor with submerged membrane filtration